CALIFORNIA DIVISION OF MINES AND GEOLOGY

fault Evaluation Report FER-8

January 5, 1979

1. Name of fault: Point Loma

2. Location of fault: Point Loma 7.5 minute quadrangle, San Diego County (figure 1)

3. Reason for evaluation: Part of 10-year program.

4. List of references:

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Artim, E.R., Bemis, C.G., Pinckey, C.J. and Smillie, B.R., 1971, Western San Diego County fault systems: Geological Society of America, Abstract with Programs (Cordilleran Section), v. 3, no. 2, p. 75.

Artim, E.R. and Pinckney, C.J., 1973, La Nacion fault system, San Diego, California: Geological Society of America Bulletin, v. 84, p. 1075-1080.
(Claims that Holocene soil broken by fault but no evidence given- no trench logs or descriptions of cuts or locations of observations.)

Elliott, W.J., 1977, New evidence concerning age of movement of the La Nacion fault, southwest San Diego County, California, in Farrand, G.T., editor, Geology of southwestern San Diego County, California and northwestern Baja, California; San Diego Association of Geologists, p. 53-58.
(A good report, it disprooves the contention of Artim and Pinckney (1973) that the La Nacion fault breaks Holocene soils. It is recommended that La Nacion fault be considered potentially active.)

Ellis, A.J. and Lee, C.H., 1919, The geology and ground water of the western part of San Diego County, California: U.S. Geological Survey Water Supply Paper 446, 321 p. (maps).
(Many photos of a very pristine landscape but no information on faults.)

Fairbanks, H.W., 1893, Geology of San Diego County; also of portions of Orange and San Bernardino Counties: California State Mining Bureau, Report 11, p. 76-120.

Fairchild Air Photos, 19 , 22930, 2-83, 84 and 85; 2-91, 92.
(On loan from Whittier College.)

Hanna, M.A., 1926, Geology of the La Jolla quadrangle, California: University of California Publications Bulletin of the Department of Geological Sciences, v. 16, no. 7, p. 187-246, map.

Hart, M.W., 1974, Radiocarbon ages of alluvium overlying La Nacion fault, San Diego, California: Geological Society of America Bulletin, v. 85, p. 1329-1332.
(Appears to give an abundance of hard evidence in addition to the age dating of soils.)

Hart, M.W., 1977, Landsliding, an alternative to faulting in San Ysidro, California, in Farrand, G.T., editor, Geology of southwestern San Diego County, California and northwestern Baja, California: San Diego Association of Geologists, p. 37-42.
(A fair argument but not so well illustrated as to be totally convincing. The possibility that faults might be there and implicated in the landslide seems to have been overlooked.)

Jennings, C.W., 1975, Fault map of California with locations of volcanoes, thermal springs and thermal wells: California Division of Mines and Geology, California Geologic Data Map Series, Map No. 1, scale 1:750,000.

Kennedy, M.P., 1968, Preliminary geologic map of a portion of northwestern San Diego City, California: California Division of Mines and Geology Open-File Resease 68-10, scale 1" = 800'.

Kennedy, M.P., 1973, Stratigraphy of the San Diego embayment, California: University of California, Riverside, unpublished Ph.D. Dissertation.

Kennedy, M.P., 1975a, Character and recency of faulting, San Diego metropolitan area, California: California Division of Mines and Geology Special Report 123, 33 p., map 1:50,000.
(Although Holocene sediments are not known to be displaced by the Rose Canyon fault zone in the onshore part of the area, offshore subbottom acoustic profiles of the area between La Jolla and Oceanside, and of the San Diego Bay and immediate offshore shelf areas south of Point Loma, show that sediments of probqble Holocene age on the sea floor are displaced by faults that appear to be related to this zone (Moore, 1972; Moore and Kennedy, 1975).)

Kennedy, M.P. and Tan, S.S., 1977, Geology of National City, Imperial Beach and Otay Mesa quadrangles, southern San Diego metropolitan area, California: California Division of Mines and Geology Map Sheet 29, map 1:24,000.
(A good map of the La Nacion fault. No Holocene displacement shown or inferred. Text covers rocks but not structure.)

Liem, T.J., 1977, Late Pleistocene maximum age of faulting, southeast Mission Bay area, San Diego, California: in Farrand, G.T., editor, Geology of southwestern San Diego County, California and northwestern Baja,California: San Diego Association of Geologists, p. 61-64.
(No data on Holocene. Data removed by grading before discovery trench was cut.)

Milow, E.D., 1961, Guide to geologic field trip of southwestern San Diego County, in Thomas, B.E., editor, Field trip guidebook: Geological Society of America, 57th Annual Meeting (Cordilleran Section) p. 23-43.

Moore, G.W., 1972, Offshore extension of the Rose Canyon fault, San Diego, California: U.S. Geological Survey Professional Paper 800-C, p. 113-116.
(Appears to offer strong evidence of Holocene activity on Rose Canyon fault zone.)

Moore, G.W. and Kennedy, M.P., 1970, Coastal geology of the California-Baja California border area: in Pacific slope geology of northern Baja California and adjacent Alta California; Geological guidebook for 1970 Fall field trip, Pacific Sections AAPG,SEPM, and SEG, p. 4-7.
(Suggests that Rose Canyon fault extends southward into Mexico. Leaves question of Holocene activity ("tectonic deformation") open.)

Kennedy, M.P., 1975b, Geology of the San Diego metropolitan area, California--Section A, western San Diego area: California Division of Mines and Geology, Bull. 200, p. 1-39, 3 plates (1:24,000).

Moore, G.W. and Kennedy, M.P., 1975, Quaternary faults at San Diego Bay, California: U.S. Geological Survey Journal of Research, v. 3, p. 589-595.

Peterson, G.L., 1970, Quaternary deformation of the San Diego area, southern California: in Pacific slope geology of northern Baja, California and adjacent Alta, California; Geological guidebook for 1970 Fall field trip, Pacific Sections AAPG, SEPM and SEG, p. 120-126.
(A good discussion of the history of Quaternary faulting and deformation in the vicinity of the Rose Canyon fault zone based on geomorphologic evidence.)

Real, C.R., Parke, D.L. and Toppozada, T.R., 1977, Magnetic tape catalog of California earthquakes, 1900-1974: California Division of Mines and Geology.

Strand, R.G., 1962, Geologic map of California-San Diego-El Centro sheet: California Division of Mines and Geology.

Toppozada, T.R., Parke, D.L. and Higgins, C.T., 1978, Seismicity of California 1900-1931: California Division of Mines and Geology, Special Report 135, 39 p.
(Showes a number of Intensity V-VI earthquakes in area of concern.)

Treet, R.L., 1977, Texas Street fault, San Diego, California: in Farrand, G.T., editor; Geology of southwestern San Diego County, California and northwestern Baja, California: San Diego Association of Geologists, p. 45-51.
(A well documented but rather long winded description of a fault possibly relatable to La Nacion and concluded not to display Holocene activity. Recommends further investigation because the fault is not exposed.)

Weber, F.H., Jr., 1963, Geology and mineral resources of San Diego County, California: California Division of Mines and Geology County Report 3, 309 p.

Wehmiller, J.F. and others, 1977, Correlation and chronology of pacific coast marine terrace deposits of continental United States by fossil amino acid stereochemistry-technical evaluation, relative ages, kinetic model ages, and geologic implication: United States Geological Survey Open-File Report 77-680, 106 p.

Wehmiller, J.F. and others, 1978, Amino-acid recemization dating of Quaternary mollusks, Pacific Coast United States: in Zartman, editor; Short papers of the fourth international conference, geochronology, cosmochronology, isotope geology, United States Geological Survey Open-File Report 78-701.
(Explains a very useful means of dating coastal, marine terrace deposits. Dates Point Loma 121,000 ± 7,000 years.

Wood, H.O., 1916, California earthquakes: Seismological Society of America Bulletin, v. 6, no. 2, p. 55-180.

Ziony, J.I. and others, 1974, Preliminary map showing recency of faulting in coastal southern California: U.S. Geological Survey Miscellaneous Field Studies Map MF-585, 3 sheets, scale 1:250,000, booklet 15 p. (No indication of Holocene activity.)

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5. Summary of available data on fault: Fairbanks (1893, p. 94-96) published the first description of the geology of Point Loma but his report did not include a map. The faults comprising the zone of the Point Loma fault first appeared on a map by Kennedy (1968) but without any name. On a map by Ziony and others (1974), showing recency of faulting in coastal southern California, some of the faults on Point Loma are shown. They are portrayed as active during the Quaternary but not the Holocene. Later work by Kennedy in California Division of Mines Special Report 123 (1975a) and Bulletin 200 (1975b) portrays the fault more clearly and names it. Faulted marine terrace deposits on Point Loma have been dated at 121,000 ± 7,000 years by Wehmiller and others (1978) using U-series ages on corals. Figure 1 is a copy of the appropriate part of the map accompanying Special Report 123 (Kennedy, 1975a). The Point Loma fault includes the separately named, Fort Rosecrans fault (Kennedy, 1975a, Plate 1). (1)

The following description of the Point Loma fault is from Kennedy (1975a, p. 13).

> The Point Loma and Fort Rosecrans faults strike north to northwest and together as a zone extend from the southwestern part of Mission Bay south to Fort Rosecrans.... Rocks of the upper Pleistocene Bay Point Formation and lower Pleistocene Linda Vista Formation are juxtaposed with Eocene strata along the Point Loma fault, and with Upper Cretaceous strata along the Fort Rosecrans fault (figures 12, 13, 14, 15; see attachment #1).
>
> The primary component of fault movement along the Point Loma fault zone is dip-slip. At the northernmost exposures

of the zone the Bay Point Formation is downdropped approximately 20m (figure 12). At Fort Rosecrans near the southernmost exposures of the zone, in the sea cliffs south of Ballast Point the Bay Point Formation is downdropped approximately 5m (figure 13). Kern (1973) has documented 12m of vertical separation along the bay shore side of Point Loma for the past 125,000 years based on fault offsets of the wave cut platform (Nestor Terrace) upon which the Bay Point Formation rests.

In the central part of the peninsula, westward from Ballast Point, strata of the Linda Vista Formation are downdropped progressively on the order of 100m by several step faults (figure 15). These faults together form the western margin of a graben that underlies San Diego Bay. The extent to which strata of the Linda Vista Formation are faulted within the central part of the graben is unknown; however, based on the presence of a restricted Pleistocene fossil gastropod, Turritella gonostoma, from a bore hole drilled near the middle of San Diego Bay beneath the Coronado Bridge at a depth of 50m (W.J. Zinsmeister, written communication) we are certain that the total vertical separation, of Pleistocene strata, from the crest of the Point Loma Peninsula to central San Diego Bay is m excess of 150 m. An average rate of vertical faulting of between 10 and 5 cm/10^3 years is suggested for the Point Loma fault zone, based on the age and extent of the faulted strata.

6. Interpretation of air photos: None

7. Field observations: None

8. Conclusions: None of the modern published reports (Kennedy, 1968, 1975; Ziony and others, 1974; Wehmiller and others 1978) describe any faulted sediments younger than late Pleistocene in the zone of the Point Loma fault. The fault, though well exposed in sea-cliffs on the flanks of Point Loma, appears to be ill-defined on the surface of the point. However, the surface of Point Loma has been altered by development. Using present project guidelines, the Point Loma fault is not believed to be sufficiently active to be considered Holocene.

9. Recommednations: Using present project guidelines, the Point Loma fault should not be zoned. There is no substantial evidence of Holocene activity. Although no further work by this projects personnel is recommended the work of other investigators should be monitored because of the relative recency of faulting and the heavily urbanized character of the area.

10. Investigating geologist's name: Richard Leard Date: 1-12-79

I concur with the recommendation not to zone.
E.W.A.
1/16/79

Figure 1
EXPLANATION

U
D
50

FAULT

Solid line where existence is certain, dashed where inferred, dotted where concealed by Holocene alluvium, U, upthrown side; D, downthrown side; single arrow and number indicate dip of fault plane, double arrows indicate sense of lateral slip.

FAULT ZONE

FAULT INFERRED FROM PHOTOGRAPHIC EVIDENCE

FAULT INFERRED FROM GEOPHYSICAL EVIDENCE
See plate 2 for magnetic, gravity and seismic data used for inference.

FAULT UNDERLYING SAN DIEGO BAY AND OFFSHORE AREA
(Modified from Moore and Kennedy in press).

SYNCLINE

ANTICLINE

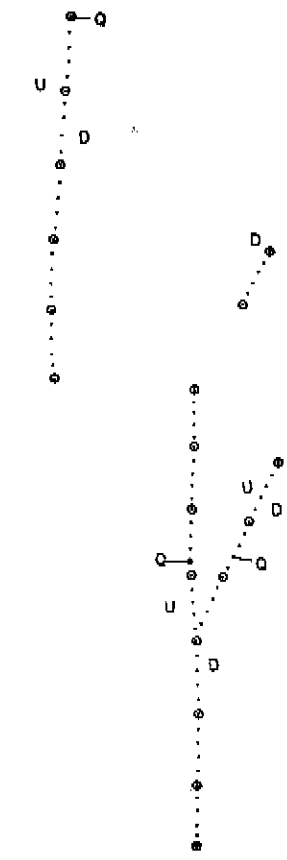
④
LOCATION OF TEXT FIGURE

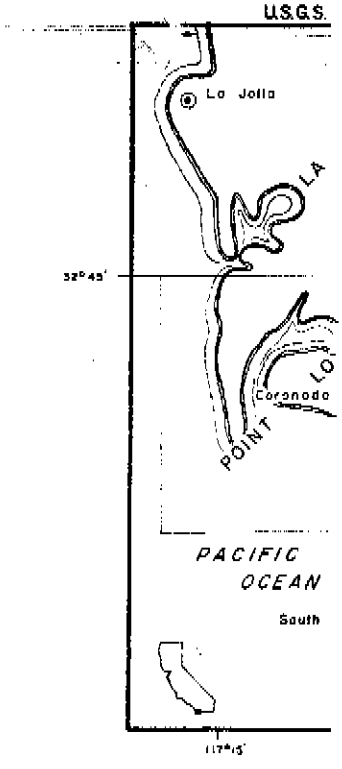
T/h
AGE OF FAULT MOVEMENT

Capital letter indicates age of strata known to be faulted, lower case letter indicates age of strata known to be unfaulted. (See key below and text discussion of ages of strata faulted and not faulted).

Key to age of fault movement symbols

Strata and age	Faulted	Not faulted
HOLOCENE (Soil, alluvium, slopewash)	H	h
LATE PLEISTOCENE (Bay Point Formation)	L	l
EARLY PLEISTOCENE (Lindavista Formation)	Q	q
TERTIARY OR OLDER STRATA (San Diego Formation, Otay Formation, Poway Group, La Jolla Group, Rosario Group)	T	t





TOPOGRAPHIC BASE BY U.S.G.S.

Kennedy (1975) figures
Keyed by number to
Figure 1

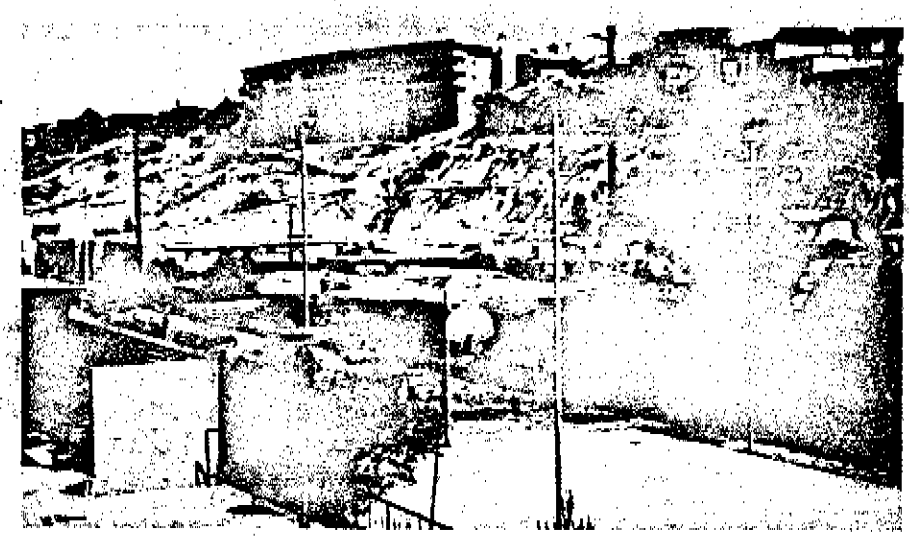


Figure 12. Trace of the Point Loma fault (marked by arrows), which juxtaposes strata of the Bay Point and Mount Soledad Formations. View northeast (see plate 1 for location).

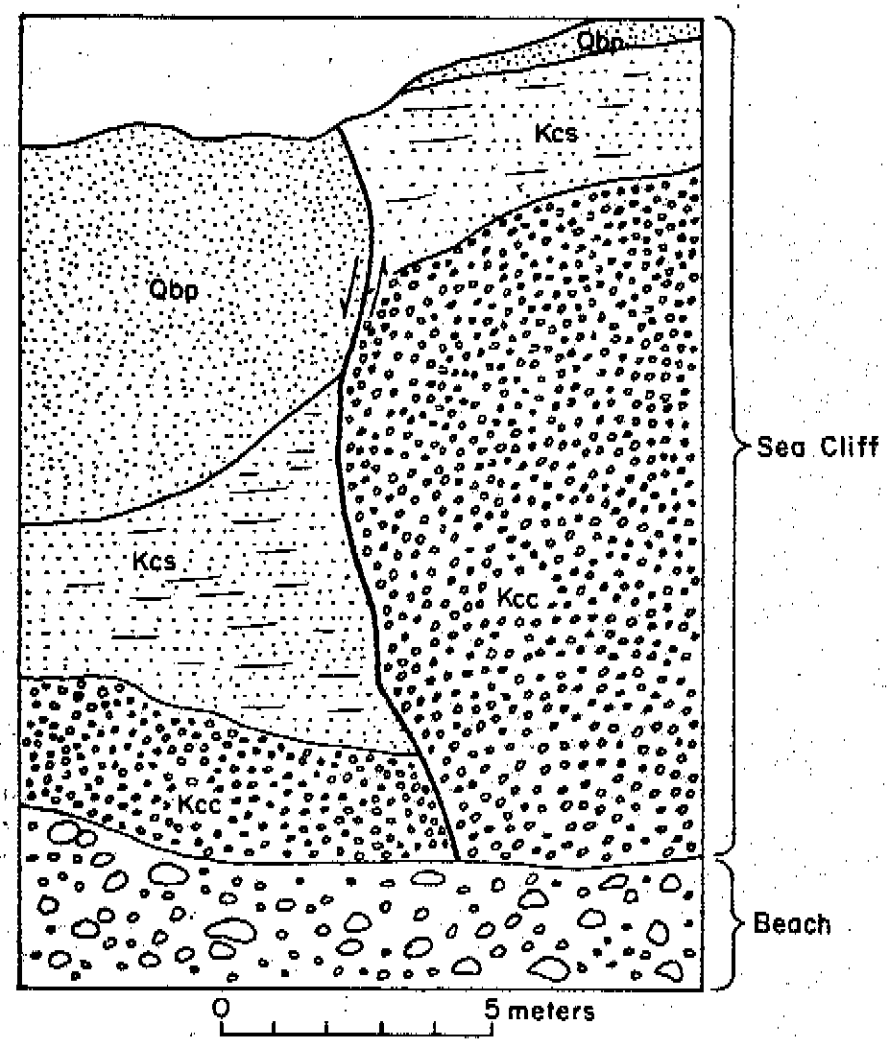


Figure 13. A dip-slip separation of 5 m occurs here, with respect to the base of the Bay Point Formation (Qbp). Faulting juxtaposes strata of the Upper Cretaceous Cabrillo Formation (Kcc, conglomerate part; Kcs, sandstone part) with the poorly consolidated sediments of the Bay Point Formation. View west (see plate 1 for location).

Point Loma F

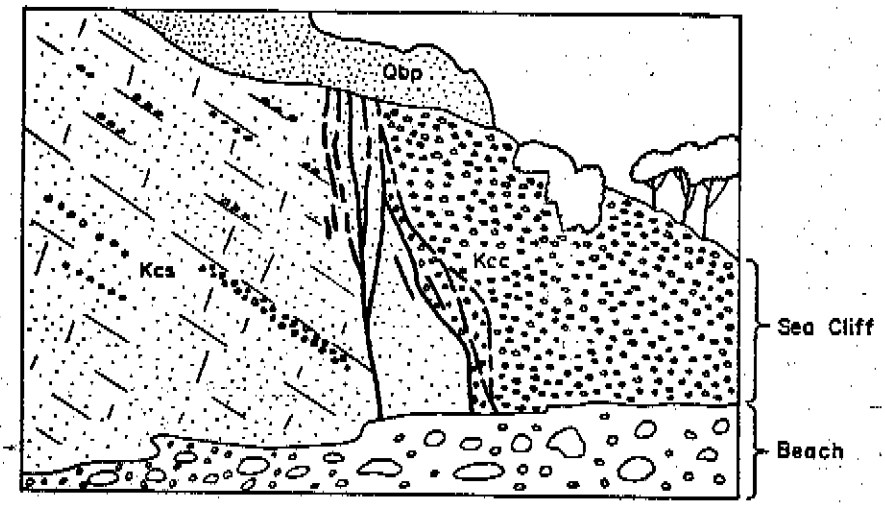


Figure 14. This fault, part of the Fort Rosecrans fault, approximately 1 m wide, juxtaposes Upper Cretaceous strata of the Cabrillo Formation (Kcc, conglomerate part; Kcs, sandstone part). The Bay Point Formation laps the fault at this location. The fault strikes N. 15°-20° W. dips 65° E. The east side is downdropped with respect to the west side. The sea cliff is about 25 feet high. View northwest (see plate 1 for location).

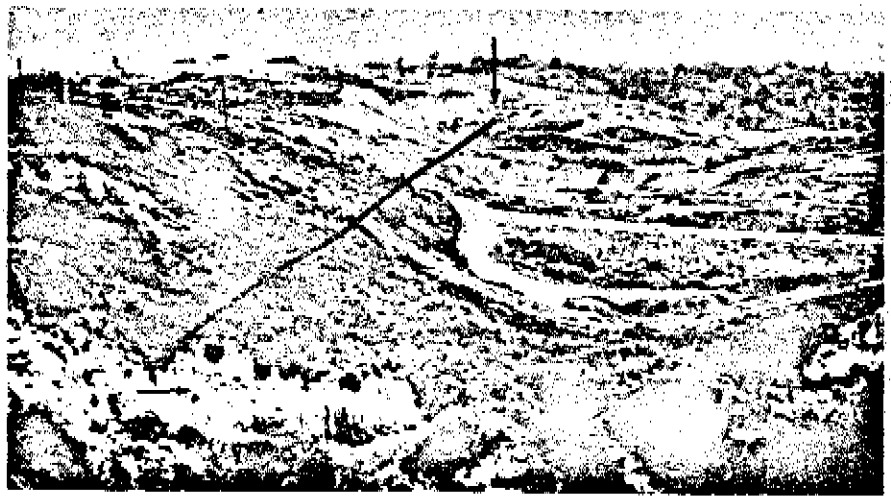


Figure 15. The Fort Rosecrans fault juxtaposes strata of the Lindavista and Cabrillo Formations. The Lindavista Formation is downdropped toward San Diego Bay (right). Arrows indicate the position of the fault in steep natural exposures. View north (see plate 1 for location).

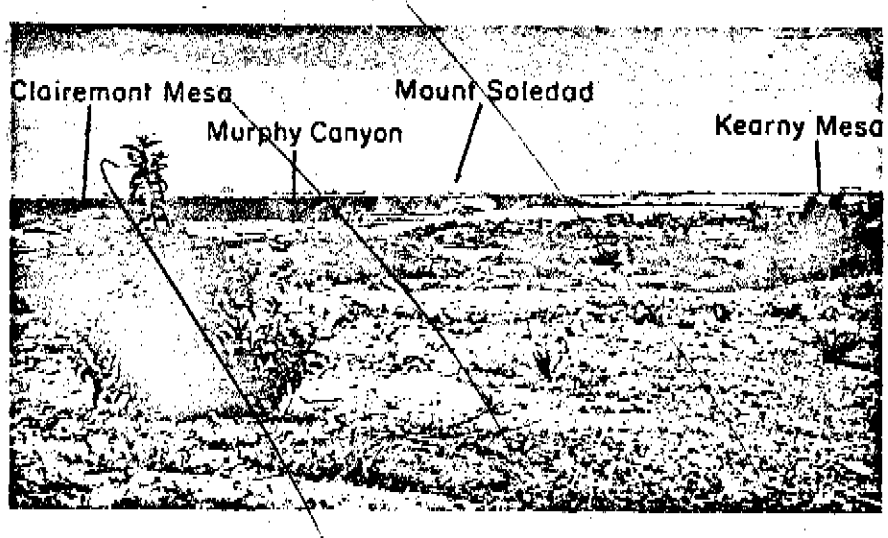
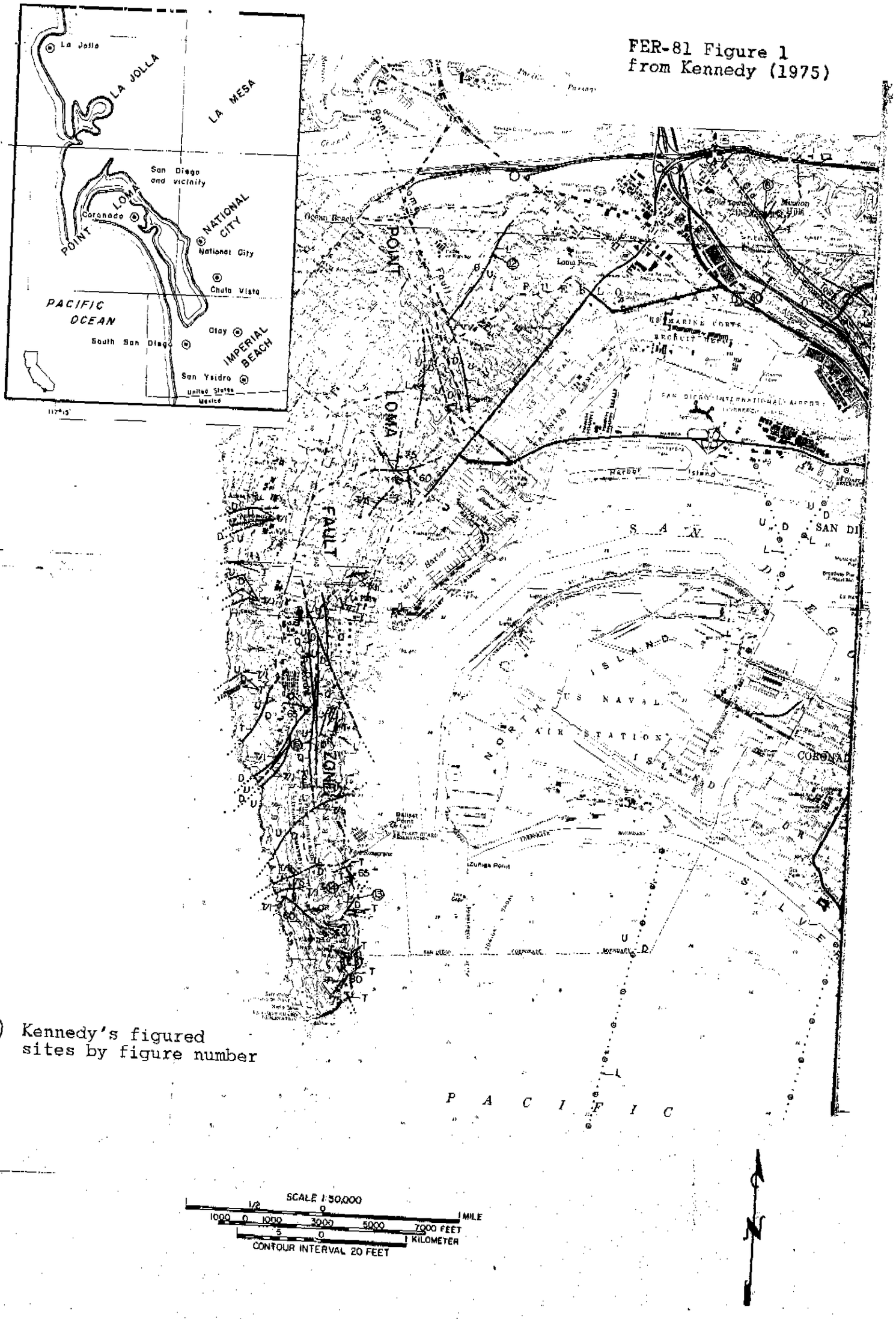


Figure 16. The elevated surface of the Lindavista Terrace along the west side of the Murphy Canyon fault. Mount Soledad, capped by the Lindavista Formation, has been elevated in Quaternary time by the Rose Canyon fault. View west (see plate 1 for location).

Point Loma fault

FER-81 Figure 1
from Kennedy (1975)



13 Kennedy's figured sites by figure number